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PATENT  
Docket No. 146712001400

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In the application of:

Samuel D. HARKNESS, IV et al

Serial No.: 09/781,978 ✓

Filing Date: February 14, 2001

For: POST-DEPOSITION ANNEALED  
RECORDING MEDIA AND METHOD  
OF MANUFACTURING THE SAME

Examiner: Bernard D. Pianalto

Group Art Unit: 1762

APPELLANT'S OPENING BRIEF

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Sir:

This is a timely appeal from the final rejection of claims 10-19 of this application.

**I. REAL PARTY IN INTEREST**

The real party in interest is Seagate Technology Holdings (formerly Seagate Technology LLC).

## II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences within the meaning of 37 CFR 1.192(c)(2) known to appellant or counsel.

## III. STATUS OF CLAIMS

Claims 10-19 (shown in Appendix 1), which are under final rejection, are the only pending claims in the application.

(a) Claim Rejections - 35 USC 103: Claims 10-19 were rejected as being obvious over Lin in view of Awschalom.

## IV. STATUS OF AMENDMENTS

The Advisory Action of June 10, 2003 states that for the purposes of Appeal, the Amendment of June 3, 2003 will be entered.

## V. SUMMARY OF THE INVENTION

The invention of this application is generally directed to a magnetic medium, such as a disc in a hard-drive of a computer, and the method of manufacturing the medium. [1:14-17]

The present invention enables the manufacture of a magnetic recording medium, comprising a substrate, a magnetic recording layer and a caplayer, wherein the caplayer has been annealed *in situ*. "*In situ*" annealing means that the medium was annealed during the manufacturing process without having to remove the medium from a sputtering system to a separate location. Preferably, the *in situ* annealing is at a temperature of from about 150°C to about 550°C for a period of from about 10 seconds to about one minute. [4:9-14]

An embodiment of this invention is a method of manufacturing a magnetic recording medium, comprising depositing a magnetic recording layer on a substrate, depositing a caplayer

on the magnetic recording layer and annealing the caplayer *in situ* at a temperature of from about 150°C to about 550°C. The method could further comprise depositing a layer comprising CoCrPt on the substrate prior to depositing the caplayer. The method could further comprise depositing a protective layer on the caplayer after annealing. The annealing could be carried out at from about 250°C to about 350°C. The annealing could be carried out for less than about 30 seconds. In a preferred embodiment, the annealing is carried out for about 14 seconds at a temperature of about 300°C. [4:21-5:7]

Another embodiment of the process could further comprise depositing a sub-seed layer on the substrate; depositing a seed layer on the substrate; depositing an underlayer on the seed layer and depositing an intermediate layer on the underlayer; wherein the magnetic layer is deposited on the intermediate layer. [5:8-11]

The magnetic layer could comprise at least one of Co, Cr, B, Pt, Ta, and Nb. The magnetic layer could comprise a layer of CoCrPt having a thickness of from about 100 nm to about 400 nm. [5:12-14]

According to one embodiment of the invention, the recording media of the present invention has a caplayer ranging in thickness of from about 0.5 nm to about 5.0 nm deposited on the magnetic layer of the medium by maintaining a system base pressure of  $1 \times 10^{-7}$  Torr with less than 50% partial pressure from background water and then using depositing means such as a disc sputtering system. Preferred is the Intevac MDP-250B system. To obtain a multilayer structure, the depositing means may also include a standard dc-magnetron-sputtering unit. [8:3-9]

Using the disc sputtering system in conjunction with a standard DC-Magnetron sputtering unit, a multilayer structure could be applied to a super-polished glass-ceramic substrate beginning with a NiAl-based seedlayer, a Cr-based underlayer, and a CoCrPt magnetic layer. A caplayer is applied on the magnetic layer. The caplayer ranges in thickness from 0.5 to 5 nm. [8:10-14]

The caplayer and the caplayer means should preferably have a Cr content of less than about 15 at.% and preferably comprises CrMn. Once the caplayer has been deposited on the magnetic layer, the recording medium is annealed *in situ*. The preferred means for annealing the caplayer is an infrared heater in the range of 10-20 kW installed in the medium processing sequence to permit *in situ* heating of the medium during fabrication. In a preferred embodiment, a 12 kW infrared heater is used to allow the caplayer to be subjected to 250°C-300°C for a period not to exceed 15 seconds. Preferably the caplayer has a thickness of about 0.8 nm and is annealed for 15 seconds at 300°C. [8:15-22]

In Example 1 of the specification, media samples were fabricated using an Intevac MDP-250B disc sputtering system as shown in Fig. 1 of the specification, which in this example was *both* the means for depositing on a substrate a caplayer and the means for annealing the caplayer. System base pressure (B.P.) was maintained below  $1 \times 10^{-7}$  Torr with < 50% partial pressure from background water. Standard dc-magnetron sputtering units were used in conjunction with the system to apply regular media multilayer structures generally composed of NiAl-based seedlayers, Cr-based underlayers and various magnetic layers to super-polished Ohara glass-ceramic substrates. CoCrPt, CoCrPtB, and CoPtTaB magnetic compositions were selected based on inherently high exchange coupling, wide grain boundary width, and narrow grain boundary width respectively. Deposition substrate temperature was maintained at 270°C. Crystallite sheet texture for all structure-types fabricated was confirmed to be (112) for the sublayer and (10.0) for corresponding magnetic layers using x-ray diffraction (XRD). In addition to the standard multilayer configuration, a caplayer of CrMn was applied to the top surface of the magnetic layer. A caplayer of CrMn is applied to the magnetic layer with a thickness of 0.8 nm and annealed *in situ* with a 12 kW infrared heater at 300°C for 15 seconds. Additional samples were processed *ex-situ* using a Modular Process Technology RTP-6005 capable of reaching temperatures of 1200 °C. [10:15-11:8]

Recording parametrics were measured using a Guzik 1701MP spinstand tester and magnetic properties were determined from vibrating sample magnetometer (VSM) measurements. Microstructural data was collected from transmission electron microscopy (TEM), and XRD. [11:9-12]

Shown in Fig. 2(a) of the specification is the coercive force of the as-deposited and as-annealed samples for media having CrMn/CoCrPt/Cr/NiAl multilayer structures, with a caplayer of 0.8 nm of CrMn. The annealed sample was *in-situ* post annealed at 300 °C for 15 seconds. The data show that *in-situ annealing greatly boosts the coercive force* of the as-deposited samples, which was *totally unexpected*. [11:13-17]

## VI. ISSUES PRESENTED FOR REVIEW

(1) Whether the Examiner erred in rejecting claims 10-19 as being obvious over Lin in view of Awschalom.

## VII. GROUPING OF CLAIMS

Group I: Claims 11-19 stand or fall together.

## VIII. ARGUMENTS

### A. The Rejections of the Claims Over the Prior Art Should be Reversed.

Claims 10-19 have been rejected as being obvious over Lin in view of Awschalom. Claim 10 recites, "annealing the caplayer *in situ* at a temperature of from about 150°C to about 550°C thereby manufacturing said magnetic recording medium." [Italics in original.] On page 4, lines 11-13, the Summary of the Invention states:

*"In situ"* annealing means that the medium was annealed during the manufacturing process without having to remove the medium

from a sputtering system to a separate location.

In the Advisory Action of June 10, 2003, the Examiner states, "The magnetic layers of the references would inherently function to record magnet [sic, magnetic] data."<sup>1</sup> The Examiner argues "inherent[] function" to support an obviousness rejection. This is not permissible according to the Federal Circuit in *In re Rijckaert*, 9 F.2d 1531, 28 USPQ2d 1955 (Fed. Cir. 1993). "Obviousness cannot be predicated on what is not known at the time of an invention is made, even if the inherency of a certain feature is later established." *Id.*

Lin discloses the fabrication process of Ni-Mn spin valve *sensor*, which is the title of Lin. A person of ordinary skill in this art would have recognized that a spin valve sensor is a recording transducer, *not* a recording medium that "would inherently function to record magnet [sic, magnetic] data." Awschalom relates to "the field of electronic and photonic circuitries. In particular, this invention relates to the implantation of submicron ferromagnetic precursors into semiconductors, to produce semiconductors with ferromagnetic activity." See column 1, lines 10-14, of Awschalom. A person of ordinary skill in this art would have recognized that the "implantation of submicron ferromagnetic precursors into semiconductors" does *not* result in the manufacture of a recording medium that "would inherently function to record magnet [sic, magnetic] data."

In the last paragraph of page 3 of the Amendment of June 3, 2003, the Applicants clarified:

As explained in Dr. Harkness' Declaration of May 9, 2003,  
"Awschalom teaches of the creation ferromagnetic semiconductors  
via ion implantation of submicron sized ferromagnetic particles"  
(paragraph 5) and "Lin teaches annealing to effect improved

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<sup>1</sup> The Examiner has not explained in what context the above statement has been made. However, the undersigned is assuming that the Examiner has made this statement because the Applicants stated, "Neither Lin nor Awschalom refer to an *in situ* annealing process for manufacturing a magnetic recording medium." See the Amendment of June 3, 2003, page 3, lines 19 and 20.

exchange coupling of NiFe/NiMn exchange bias layers (in a spin valve (SV) recording transducer)" (paragraph 6). Any reference to the words "in-situ" and "annealing" in Awschalom and Lin is *not* in the context "of manufacturing a magnetic recording medium" as recited in claim 10.

The Applicants re-emphasize, as stated in Dr. Harkness' Declaration of May 9, 2003, that a person of ordinary skill in this art would have recognized that any reference to the words "in-situ" and "annealing" in Awschalom and Lin is *not* in the context "of manufacturing a magnetic recording medium" as recited in claim 10. Neither Lin nor Awschalom states that the magnetic layers in the valve sensor of Lin or the ferromagnetic semiconductors of Awschalom can record magnetic data.

For something to be inherently disclosed in a reference, it is required that "the missing descriptive matter is *necessarily present* in the thing described in the reference, and that it would be so *recognized* by persons of ordinary skill." *Continental Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991) (emphasis added). The Examiner argues that "[t]he magnetic layers of the references would inherently function to record magnet [sic, magnetic] data" without providing *any* evidence to support the "inherency" argument as required by *Continental Can. Id.*

Particularly because the Examiner is combining references in making the obviousness rejection, the Examiner *must* provide evidence that the magnetic layers of the references can *necessarily* record magnetic data rather than taking official notice that "[t]he magnetic layers of the references would inherently function to record magnet [sic, magnetic] data." On the issue of combining references, the Federal Circuit in *In re Sang Su Lee*, 277 F.3d, 1338, 61 USPQ2d 1430 (Fed. Cir. 2002), specifically states, "The need for specificity pervades this authority ... [and] *particular findings must* be made as to the reason the skilled artisan, with *no* knowledge of the claimed invention, would have selected these components for combination in the manner claimed." [Citations omitted; emphasis added.] In light of the decisions of *In re Sang Su Lee*

and *In re Zurko*, 258 F.3d 1379, 1385 59 USPQ2d 1693, 1697 (Fed. Cir. 2001), MPEP 2144.03 specifically states, "It would not be appropriate for the examiner to take official notice of facts without citing a prior art reference where the facts asserted to be well known are not capable of instant and unquestionable demonstration as being well-known." [Emphasis in original.]

Furthermore, MPEP 2144.03 states, "**If Applicant Challenges a Factual Assertion as Not Properly Officially Noticed or not Properly Based Upon Common Knowledge, the Examiner Must Support the Finding With Adequate Evidence.**" The Applicants respectfully challenge the Examiner to provide evidence supporting his statement that "[t]he magnetic layers of the references would inherently function to record magnet [sic, magnetic] data."

The processes of Lin and Awschalom do *not* relate to a method of manufacturing a *magnetic recording medium*, which is an element of claim 10. The statement by the Examiner that "[t]he magnetic layers of the references would inherently function to record magnet [sic, magnetic] data" is nothing more than a retrospective view of "inherency" in light of this invention which is directed to a method of manufacturing a magnetic recording medium. "[A] retrospective view of inherency is not a substitute for some teaching or suggestion which supports the selection and use of the various elements in the particular claimed combination." *In re Newell*, 891 F.2d 899, 13 USPQ2s 1248 (Fed. Cir. 1989).

*Nowhere* do the cited references explicitly or inherently disclose "annealing the caplayer *in situ* at a temperature of from about 150°C to about 550°C thereby manufacturing said magnetic recording medium" as recited in claim 10. Applicants respectfully submit that the Examiner has ignored the fundamental rules for determining obviousness. To establish a *prima facie* case of obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

The cited prior art references do not teach or suggest the claimed invention, which is directed to a method of manufacturing a *magnetic recording medium*. In particular, there is no



suggestion in the prior art to employ the *in situ* annealing step in a process for manufacturing a magnetic recording medium. Besides, one of ordinary skill in this art would *not* even have been motivated to combine Lin and Awschalom, as neither attempts to fill a need similar to that first recognized by the Applicants and satisfied by this invention. It is the Applicants who first recognized a need for "a method of producing a recording medium that provides a magnetic recording medium with a high linear recording density, high signal to noise ratio, and high coercivity that can be integrated into current manufacturing processes economically and efficiently where the recording medium does not need to be exposed to high energy sources for long periods of time or removed or subjected to multiple manufacturing process such as the *ex situ* annealing process of Coffey [i.e., prior art]." See specification, page 3, line 21 to page 4, line 3.

The only suggestion, if at all there is one, to combine Lin and Awschalom and attempt to arrive at the claimed invention arises from the hindsight gained from this invention, not from the cited references. However, hindsight is not permissible in gathering prior art or in combining references.

In the Advisory Action, the Examiner also states, "Applicants argue unexpected results referring to page 11, lines 5-17 but none of applicants claims are so limited." The Examiner's statement that "Applicants argue unexpected results" should be treated as an acknowledgement by the Examiner that the disclosure on page 11, lines 5-17, establishes the unexpected results due to *in situ* annealing as compared to *ex situ* annealing. This is because the Examiner has not provided any persuasive basis to question Applicants' comparative data and assertion that the demonstrated results were unexpected. Thus, in accordance with the decision in *In re Soni*, 34 USPQ 2d 1684, 1687-88 (Fed. Cir. 1995), it would be improper to arrive at a finding that the Applicants have not established unexpected results. The Federal Circuit in *In re Soni*, 34 USPQ 2d 1684, 1687-88 (Fed. Cir. 1995) stated:

Here, Soni's specification contains more than mere argument or conclusory statements; it contains specific data indicating improved properties. It also states that the improved properties provided by the claimed compositions "are much greater than would have been predicted given the difference in their molecular weights." . . .

Mere improvement in properties does not always suffice to show unexpected results. In our view, however, when an applicant demonstrates substantially improved results, as Soni did here, and states that the results were unexpected, this should suffice to establish unexpected results in the absence of evidence to the contrary. Soni, who owed the PTO a duty of candor, made such a showing here. The PTO has not provided any persuasive basis to question Soni's comparative data and assertion that the demonstrated results were unexpected. Thus, we are persuaded that the Board's finding that Soni did not establish unexpected results is clearly erroneous.

The Examiner's contention does not appear to be that the Applicants have not demonstrated unexpected results but that "none of applicants claims are so limited." The Examiner, however, does not clarify what is meant by "so limited."

If "so limited" means that the claims should recite the unexpected results, then the Applicants respectfully submit that there is *no* requirement that the claims should recite the unexpected results. Instead, the claims should recite the invention that produces the unexpected results. "[O]ne way for a patent applicant to rebut a prima facie case of obviousness is to make a showing of 'unexpected results,' i.e., to show that *the claimed invention* exhibits some superior property or advantage that a person of ordinary skill in the relevant art would have found surprising or unexpected." *In re Geisler*, 116 F.3d 1465, 43 USPQ2d 1562 (Fed. Cir. 1997); (citations omitted; emphasis added).

On the other hand if "so limited" refers to "the claimed invention," then the Applicants respectfully submit that the claims are limited to a method of manufacturing a magnetic recording medium that produces the unexpected results. The disclosure on page 11, lines 5-17 of the specification discusses the unexpected results obtained by *in situ* processing versus *ex situ*

processing. The unexpected results, viz., the greatly improved coercive force as discussed on page 11, lines 5-17 of the specification, are due to annealing the caplayer *in situ*. Claim 10 is clearly limited to "annealing the caplayer *in situ*." [Italics in original.] Thus, the Examiner's contention that "Applicants argue unexpected results referring to page 11, lines 5-17 but *none* of applicants claims are so limited" (emphasis added) is clearly incorrect.

Note that the situation in the pending application is unlike that in *In re Gartside*, 203 F.3d 1305, 53 USPQ2d 1769 (Fed. Cir. 2000), in which a declaration setting forth "unexpected results" in examples from a test of a process was not probative of nonobviousness because the test did not correspond to any process within the scope of the claims. In the pending case, the test showing unexpected results corresponds to the *very* process disclosed in an example of specification and claimed.

"Objective evidence such as commercial success, failure of others, long-felt need, and unexpected results must be considered before a conclusion of obviousness is reached . . . ." *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1380 (Fed. Cir. 1986) (citations omitted), *cert. denied*, 480 U.S. 947, 94 L. Ed. 2d 792, 107 S. Ct. 1606 (1987). Applicants respectfully submit that "[c]onsistent with the rule that all evidence of nonobviousness *must* be considered when assessing patentability, the PTO *must* consider comparative data in the specification in determining whether the claimed invention provides unexpected results." *In re Soni*, 34 USPQ 2d 1684, 1687-88 (Fed. Cir. 1995) (emphasis added). Thus, even assuming that the Examiner has established a *prima facie* case of obviousness, which Applicants deny, the obviousness rejection over Lin in view of Awschalom should be withdrawn because of a showing of unexpected results, namely, "annealing the caplayer *in situ*." *See In re Dillon*, 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), *cert. denied*, 500 U.S. 904 (1991)).

## CONCLUSIONS

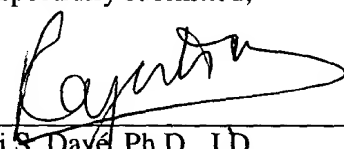
For the foregoing reasons, Applicants submit that the anticipating and obviousness rejections should be withdrawn.

In the event that the transmittal letter is separated from this document and the Patent and Trademark Office determines that an extension and/or other relief is required, applicants petition for any required relief including extensions of time and authorize the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to Deposit Account No. 03-1952, referencing docket number 146712001400.

Respectfully Submitted,

Date: August 20, 2003

By: \_\_\_\_\_

  
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## APPENDIX 1

10. A method of manufacturing a magnetic recording medium, comprising:  
depositing a magnetic recording layer on a substrate,  
depositing a caplayer on the magnetic recording layer and  
annealing the caplayer *in situ* at a temperature of from about 150°C to about 550°C thereby manufacturing said magnetic recording medium.
11. The method of claim 10, further comprising depositing a layer comprising CoCrPt on the substrate prior to depositing the caplayer.
12. The method of claim 10, further comprising depositing a protective layer on the caplayer after annealing.
13. The method of claim 10, wherein annealing is carried out at from about 250°C to about 350°C.
14. The method of claim 10, wherein the annealing is carried out for less than about 30 seconds.
15. The method of claim 10, wherein the annealing is carried out for about 14 seconds at a temperature of about 300°C.
16. The method of claim 15, wherein the caplayer has a thickness of from about 0.5 nm to about 5 nm.

17. The method of claim 10, wherein prior to depositing the caplayer on the substrate, the process further comprises:

depositing a sub-seed layer on the substrate;

depositing a seed layer on the substrate;

depositing an underlayer on the seed layer and

depositing a intermediate layer on the underlayer;

wherein the magnetic layer is deposited on the intermediate layer.

18. The method of claim 17, wherein the magnetic layer comprises at least one of Co, Cr, B, Pt, Ta, and Nb.

19. The method of claim 18, wherein the magnetic layer comprises a layer of CoCrPt having a thickness of from about 100 nm to about 400 nm.